Warm Up:

47% of South students say that they are smokers. We take a sample of 5 South students.

a) create the probability distribution for X, the number of smokers

X	P(x)
0	0.04182
1	0.18543
2	0.32887
3	0.29164
4	0.12931
5	0.02293

b) $P(x \geq 2) = 0.77275$

c) $P(x < 3) = 0.55612$

b) what is the probability that at least 2 students smoke?

c) what is the probability that less than 3 students smoke?

d) what is $P(1 < X \leq 4)$? $= 0.74942$

5.1

Binomial Distributions

4 conditions:

- Must have a set # of trials/obs/sample $n=5$
- All of the observations are independent
- Only 2 outcomes: success/failure
- The probability of success remains constant $p=0.47$

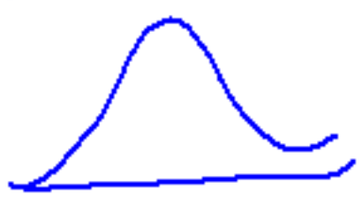
Notation: $B(n, p)$ ← prob. success

$B(5, 0.47)$

$\mu_x = n \cdot p$

$\sigma_x = \sqrt{n \cdot p \cdot (1-p)}$

$N(\mu, \sigma)$



$\mu_x = 5(0.47)$

$E(x) =$

Binomial Probabilities

- We already know the formula for this!
- Binomial random variables are just... discrete random variables
- Formula: $P(X=k)=\binom{n}{k}p^{k}(1-p)^{(n-k)}$
- Example: Computer chips have a 25% chance of being defective. Create the probability distribution for X, if X is the # of defective chips in a sample of 4.

$B(4, 0.25)$

X	P(X)
0	$(4nCr0)(0.25^0)(0.75^4)=0.3164$
1	$=0.4219$
2	$=0.2109$
3	$=0.0469$
4	$=0.0039$

So let's answer some easy questions:

$P(X=2) =$ 0.2109

$P(X<2) =$ 0.7383

$P(X \geq 3) =$ 0.0508

$P(2 \leq X \leq 4) =$ 0.2617

Now let's look at changing the sample size to **10**, and answering similar questions:

X	P(X)
0	0.0563
1	0.1877
2	0.2816
3	0.2503
4	0.1460
5	0.0584
6	0.0162
7	0.0031
8	0.00039
9	0.000029
10	0.0000009 54

P(X=9) = 0.000029

P(X<4) = 0.7759

P(X≥6) = 0.01972

P(5≤X≤7) = 0.0777

$P(X \geq 1) =$

$1 - P(X = 0)$

$P(X < 4) = P(X \leq 3)$

$P(X \geq 6) = P(X > 5) = 1 - P(X \leq 5)$

Would you want to answer these questions for a sample size of 30? Of 50? Of 100?
So we can use the calculator

For P(X=k)

- Use binompdf(n, p, k)
- k = # of 'successes"
- pdf = prob. density fctn. (formula)

x	P(x)

For P(X≤k)

- Use binomcdf(n, p, k)
- k = # that's ≤
- Notice that is ONLY GIVES YOU ≤
- cdf = cumulative density fctn.

P(X≥3) 1−P(X≤

However you MUST still write prob. notation P( )=ans.

Example:

- John is taking archery.
- He has a 30% chance of hitting the target each time he shoots.
- He shoots 8 times

$B(8, 0.30)$

1) What is the probability that he hits the target 4 times?

$P(X=4) = \text{binompdf}(8, 0.30, 4) = 0.1361$

2) What is the probability that he hits the target 2 times or less?

$P(X \leq 2) = \text{binomcdf}(8, 0.3, 2) = 0.5518$

3) What is the probability that he hits the target at least 3 times?

$P(X \geq 3) = 1 - P(X \leq 2) = 1 - \text{binomcdf}(8, 0.3, 2) =$

0.4482

4) What is the probability that he hits the target less than 5 times?

$P(X < 5) = P(X \leq 4) = 0.9420$

5) What is the probability that he hits the target more than 6 times?

$P(X > 6) = 1 - P(X \leq 6) = 1 - \text{binomcdf}(8, 0.3, 6) = 0.0013$

B(150, 0.45)

1. mean = 67.5
2. std. dev = 6.093

$\mu = n \cdot p$

$\sigma = \sqrt{n \cdot p \cdot (1-p)}$

3. P(X=75) = 0.0306

4. P(X≤60) = 0.1251

5. P(X≥60) = 1-P(X≤59) = 0.9058

6. P(X<60) = P(X≤59) = 0.0942

7. P(X>60) = 1-P(X≤60) = 0.8749

8. 90 = n*p
   90 = n*(0.45)
   n = 200

HOMEWORK:

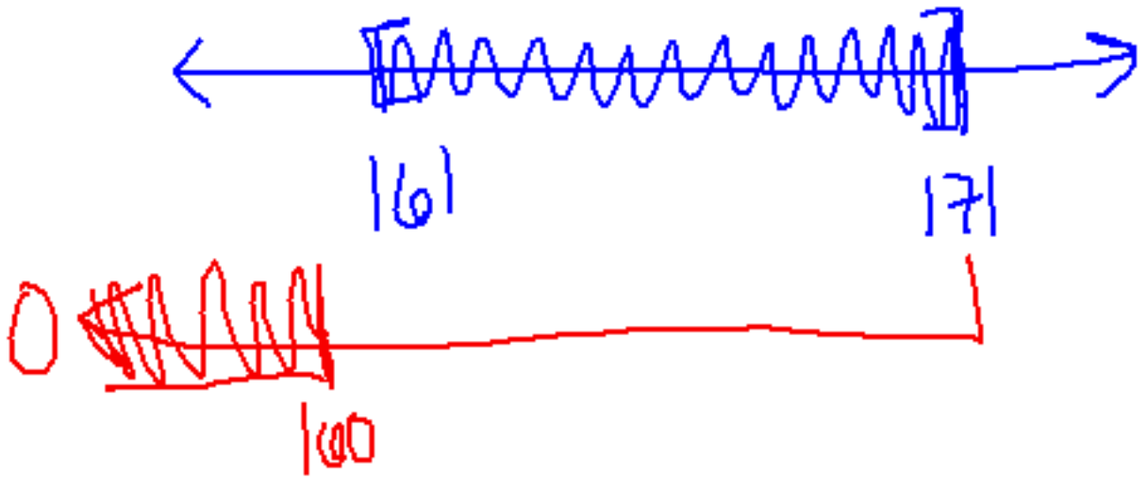
p. 390 #1--3, 6, 11, 12, 13, 17

TEST FRIDAY

(9)

mean = 166

std. dev. = 5.3122



within 1 std. dev:

166-5.3122 = 160.6878

166+5.3122 = 171.3122

Prob:

$P(160.6878 \leq X \leq 171.3122) =$

$P(161 \leq X \leq 171)$

binomcdf (171) - binomcdf(160)